Title: Anatomath with the TI-80

Link to Outcomes:

- **Problem Solving** Students will demonstrate their ability to solve problems in a cooperative atmosphere with the use of technology.
- **Communication** Students will express what they have learned by interpreting tables and graphs.
- **Reasoning** Students will reason mathematically by making predictions, gathering evidence, and building arguments.
- **Connections** Students will relate measurement, statistics, algebra, and technology.
- **Measurement** Students will apply concepts of measurement by using a metric tape measure.
- **Statistics** Students will collect and organize data to draw a conclusion.
- **Algebra** Students will review the algebraic process of graphing scatter plots on the coordinate plane.
- **Technology** Students will input and analyze data using a TI-80 graphing calculator.
- **Number Relationships** Students will represent ratios as decimals for the purpose of comparing values.

Brief Overview:

Students will use a TI-80 graphing calculator to construct a scatter plot using class data collected while in small groups. Data will consist of four measurements for each student: radius, foot, index finger, height. Students will be asked to determine if relationships exist between lengths of specific body parts. Students will arrive at their conclusions by using scatter plots, ratios, and decimal equivalents. Algebra students will also apply correlation coefficients and linear regressions. Teacher's note: It is suggested that this be a culminating activity for a statistics unit due to the prerequisite components.

Grade/Level:

Grades 7-8.

Duration/Length:

Two to four class periods should be sufficient time to complete the basic learning unit. If extensions are utilized, be prepared to plan more time.

Prerequisite Knowledge:

Students should be able to perform the following:

- Read and record measurements from a tape measure
- Express ratios from given data
- Change ratios to decimal equivalents
- Operate a TI-80 graphing calculator (helpful but not mandatory)
- Understand the concept of correlation coefficients
- Recognize a positive, negative, or no association in data on a scatter plot

Objectives:

- Students will predict whether there is a correlation between the lengths of four specific body parts.
- Students will work cooperatively in small groups to measure and record data.
- Students will collect a class set of data.
- Students will write ratios and the decimal equivalents to compare lists of data.
- Students will use the TI-80 graphing calculator to input data, graph and analyze scatter plots.
- Algebra students will calculate linear regressions and correlation coefficients from the TI-80.
- Students will sketch scatter plots from the TI-80.
- Students will work together to answer questions relating to the collected data.
- Students will develop a conclusion supporting or contradicting their predictions.

Materials/Resources/Printed Materials:

- Metric tape measures
- Worksheets 1 - 3
- TI-80 calculators and accompanying guidebooks
- Writing instruments

Development/Procedures:

- Familiarize students with the terms for the body parts to be measured: radius (forearm, wrist to elbow), foot, index finger, height.

- Use questioning techniques to have students discuss and discover how to compare, predict, and test the length relationships among the body parts.

- Review how to measure accurately (to the nearest tenth of a centimeter) using a tape measure.

- Assign students to small groups.

- Monitor students' writing of predictions and collecting of group data (see worksheet one).

- Organize the collection of data from the whole class and discuss the question on the bottom of worksheet one.

- Have students, working in groups, select sets of data from worksheet one to complete worksheet two. Teacher's note: Any type of calculator may be used to calculate the decimal equivalents.

- Distribute TI-80 calculators and guidebooks.

- Provide students with appropriate level of instruction for resetting the calculator (see guidebook page 12-4) and plotting statistical data (see guidebook page 9-18). When setting up scatter plots via the stat plot menu, be sure students enter the correct lists for each plot (see ratio column on worksheet two). All three scatter plots can be displayed on the calculator simultaneously. Be sure to choose an appropriate window for the data collected. CAUTION: These procedures contain many steps. The teacher should be aware of his/her students' proficiency level using the calculators. Appropriate planning should take place prior to lesson. (The guidebook provides practice for statistical plotting beginning with page 9-2.)

- If necessary, preview the additional information labeled 'Calculator Help' available at the end of this lesson.

- Supervise and assist student groups with worksheet three. Teacher information: scatter plots and correlation coefficients show that a relationship exists; ratios and decimal equivalents show the numerical value of a relationship.

- Evaluate students' conclusions. Teacher information: ratio for L1/L2 is approximately 1/1; ratio for L2/L4 should show no association; ratio for L3/L4 is approximately 1/20.

Evaluation:

Student progress will be assessed by the teacher throughout the discussions, activities, and completion of the written work. Specifically, the student's conclusions and supporting arguments will be evaluated.

Extension/Follow Up:

Students can measure family members or individuals from a different age group to discover if the ratios are consistent.

Students can calculate the mean, median, and mode(s) of each list and determine which measure of central tendency would best be applied to this data.

Algebra students will find the linear regression and correlation coefficient for each scatter plot to decide if linear models of the data exist.

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WORKSHEET ONE

PREDICTION(S): Explain what relationships you think exist among the body part lengths we will be considering.

BODY LENGTHS MEASUREMENT CHART
Measure each student in your group. Remember to record each measurement to the nearest tenth of a centimeter. Record your measurements in the correct boxes.

	L1 - radius	L2 - foot	L3 index finger	L4 - height
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
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What are some other ways mathematicians display or manipulate data for the purpose of comparing?

WORKSHEET TWO

RATIO/DECIMAL CHART
Refer to worksheet one and select data from ten students. For each student data set, record the ratios and find the decimal equivalents.

	ratio L1/L2	decimal equivalent	ratio L2/L4	decimal equivalent	ratio L3/L4	decimal equivalent
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

V. THINK AGAIN

What is the pattern of the decimal equivalents for each ratio?

a. L1/L2

b. L2/L4

c. L3/L4

Based on these patterns or lack of patterns, would you change any of your prediction(s) from Worksheet One? If yes, rewrite your prediction(s).

WORKSHEET THREE

CALCULATOR CALCULATIONS

Refer to the three scatter plots to answer the following questions.

1. In the space below, sketch an approximation of the scatter plots from your TI-80 calculator.

2. If a straight line was drawn through each scatter plot, approximately how many of the 10 data points would it touch? What does this tell you about the data in each scatter plot?

a. (L1, L2)

b. (L2, L4)

c. (L3, L4)

3. Do you think each scatter plot suggests a positive, negative, or no association between the lengths? Explain.

a. (L1, L2)

b. (L2, L4)

c. (L3, L4)

CHALLENGE QUESTION

You have looked at the ratios, the decimal equivalents, and the scatter plot for different body part lengths. Each of these provides information about the two lengths compared. How is the information provided by the ratios and decimal equivalents different from the information provided by the scatter plots?

FINAL THOUGHTS

Using the information that you have discovered, write conclusions describing the relationships between the lengths of the body parts compared. Include in your statements supporting evidence gathered in this activity.

a. radius to foot

b. foot to height

c. index finger to height

CALCULATOR HELP - guidebook Chapter 9, 'Statistics', provides additional info

1. Entering lists - for scatter plots x and y lists must have equal number of entries
STAT menu
Select 1) EDIT

2. Setting up scatter plots - all plots that are turned on will be displayed
STAT PLOT menu
Plot 1
  On Scatter L1 L2 +
Plot 2
  On Scatter L2 L4 -
Plot 3
  On Scatter L3 L4

3. Setting the appropriate window to match statistical data
WINDOW menu
xmin=1
xmax=40
xscl=1
ymin=1
ymax=200
yscl=1

4. Graphing the scatter plots from the information entered
GRAPH

5. Calculating linear regression and correlation coefficient
STAT menu, arrow right to CALC
Select 3) LINREG (ax+b)
Enter x-list, y-list

6. Graphing linear regression
Y= menu
VARS menu
Select 2) STATISTICS
arrow right EQ menu
Select 5) REGEQ
GRAPH
Note: Repeat steps 5 and 6 for each plot